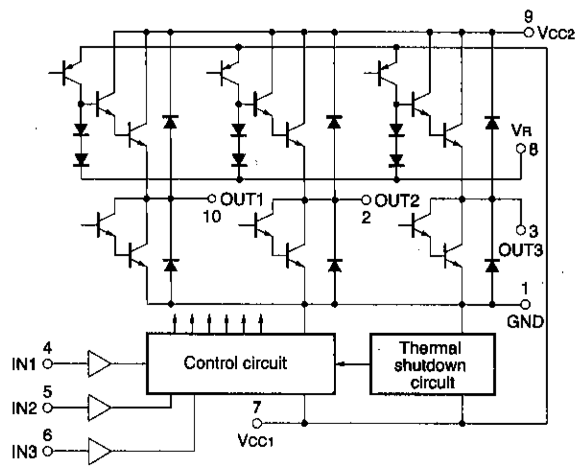
2-channel reversible motor driver
BA6238A/BA6238AN/BA6239A/BA6239AN

The BA6238A, BA6238AN, BA6239A, and BA6239AN are monolithic ICs incorporating two reversible-motor drivers that are suitable for driving small DC brush motors.
The logic input section for controlling each motor can be easily connected with CMOSs and other control logic outputs. The torque during loading can be varied by controlling the voltage supplied to the motor with pin 8 of the output section.
With a limited number of external parts, each driver has a function of two reversible-motor drivers.

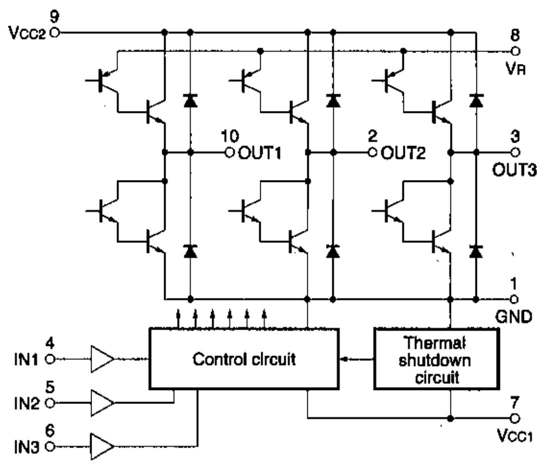
●Applications
VCRs and audio tape recorders

●Features
1) Two reversible-motor driver circuits are built in. (not operable at the same time)
2) Limited number of external parts.
3) Interface with CMOS devices. (protective resistor required when the CMOS output is higher than 5V)
4) Built-in power transistor for motor driving.
5) Built-in diode to absorb surge currents.
6) Built-in thermal shutdown circuit. (the circuit breaks the output when the chip temperature is increased due to such an event as motor locking)

●Block diagram



BA6238A / BA6238AN



BA6239A / BA6239AN

●Absolute maximum ratings (Ta=25℃)

BA6238A/BA6238AN

Parameter		Symbol	Limits	Unit
Power supply voltage		V_{CC}	20	V
Power dissipation	BA6238A	Pd	2200*1	mW
	BA6238AN		1000*2	
Operating temperature		Topr	−25~75	℃
Storage temperature		Tstg	−55~125	℃
Input voltage		V_{IN}	−0.3~5	V
Output current		I_{OUT}	1.6*3	A

*1 Refer to the power dissipation characteristics (Fig. 8) for details.
*2 Refer to the power dissipation characteristics (Fig. 9) for details.
*3 500 μs pulse with a duty ratio of 1%.

BA6239A/BA6239AN

Parameter		Symbol	Limits	Unit
Power supply voltage		V_{CC}	20	V
Power dissipation	BA6239A	Pd	2200*1	mW
	BA6239AN		1000*2	
Operating temperature		Topr	−25~75	℃
Storage temperature		Tstg	−55~125	℃
Input voltage		V_{IN}	−0.3~5	V
Output current		I_{OUT}	1.2*3	A

*1 Refer to the power dissipation characteristics (Fig. 8) for details.
*2 Refer to the power dissipation characteristics (Fig. 9) for details.
*3 500 μs pulse with a duty ratio of 1%.

●Recommended operating conditions (Ta=25℃)

BA6238A/6238AN

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC1} V_{CC2}	8	−	18	V
Power supply voltage	V_R	0	−	18	V

BA6239A/6239AN

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC1} V_{CC2}	8	−	18	V
Power supply voltage	V_R	8	−	18	V

●Electrical characteristics (unless otherwise noted, Ta=25℃ and Vcc=12V)

BA6238A/BA6238AN

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Circuit current	I_{CC}	–	12	24	mA	R_L=∞ ; 4, 5, 6pin="L"	Fig.1
LOW level input voltage of pins 4, 5, and 6	V_{IL}	–	–	1.0	V	–	Fig.1
HIGH level input voltage of pins 4, 5, and 6	V_{IH}	4.0	–	–	V	–	Fig.1
LOW level output voltage of pins 2, 3, and 10	V_{OL}	–	0.8	1.5	V	8pin=open, I_O=0.5A	Fig.1
HIGH level output voltage of pins 2, 3, and 10	V_{OH}	10	10.5	–	V	8pin=open, I_O=0.5A	Fig.1
Output leakage current	I_{OL}	–	–	1	mA	Current flowing into pin 9 when pin 4, 5, 6 = LOW and R_L = ∞	Fig.1
Output offset voltage of pin 2	ΔV_2	−0.5	–	0.5	V	V_R=6.0V In reference to pin 8, $I_{O(2)}$ = 0.5 A	Fig.1
Output offset voltage of pin 3	ΔV_3	−0.5	–	0.5	V	V_R=6.0V In reference to pin 8, $I_{O(3)}$ = 0.5 A	Fig.1
Output offset voltage of pin 10	ΔV_{10}	−0.5	–	0.5	V	V_R=6.0V In reference to pin 8, $I_{O(10)}$ = 0.5 A	Fig.1
Pin 8 source current 1	$I_{8(2)}$	0.2	0.6	1.5	mA	2pin= "H", $I_{(2)}$ =0.5A V_R=6.0V	Fig.1
Pin 8 source current 2	$I_{8(3)}$	0.2	0.6	1.5	mA	3pin= "H", $I_{(3)}$ =0.5A V_R=6.0V	Fig.1
Pin 8 source current 3	$I_{8(10)}$	0.2	0.6	1.5	mA	10pin= "H", $I_{O(10)}$ =0.5A V_R=6.0V	Fig.1
Backlash current	I_B	–	–	0.3	A	Pin 4, 5, 6 = LOW; current flowing into pin 9 when one of the output pins is -1 V	Fig.1
Thermal shutdown activation temperature	T_{ON}	–	150	–	℃	–	Fig.1
Thermal shutdown deactivation temperature	T_{OFF}	–	100	–	℃	–	Fig.1

BA6239A/BA6239AN

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Circuit current	I_{CC}	–	12	24	mA	R_L=∞ 4, 5, 6pin="L"	Fig.2
LOW level input voltage of pins 4, 5, and 6	V_{IL}	–	–	1.0	V	–	Fig.2
HIGH level input voltage of pins 4, 5, and 6	V_{IH}	4.0	–	–	V	–	Fig.2
LOW level output voltage of pins 2, 3, and 10	V_{OL}	–	0.8	1.5	V	R_L=100Ω	Fig.2
HIGH level output voltage of pins 2, 3, and 10	V_{OH}	10.5	11.2	–	V	R_L=100Ω	Fig.2
Output leakage current	I_{OH}	–	–	1	mA	Current flowing into pin 9 when pin 4, 5, 6 = LOW . R_L=∞	Fig.2

●Measurement circuit

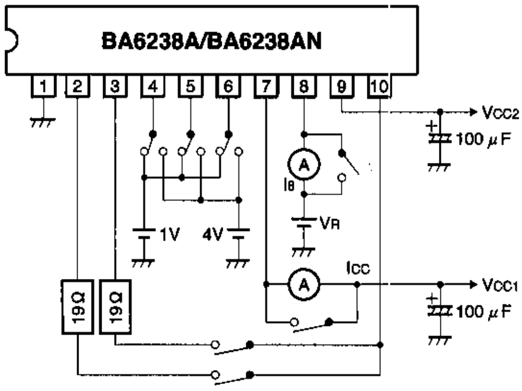


Fig.1 BA6238A / BA6238AN

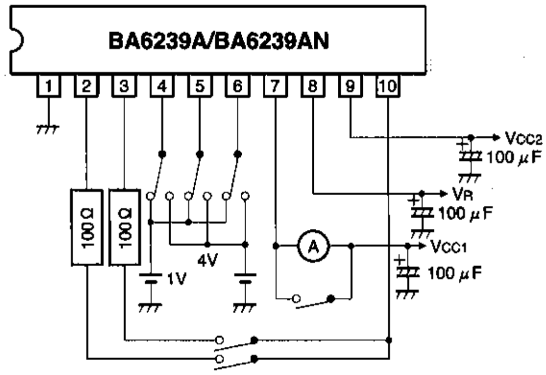


Fig.2 BA6239A / BA6239AN

●Application example

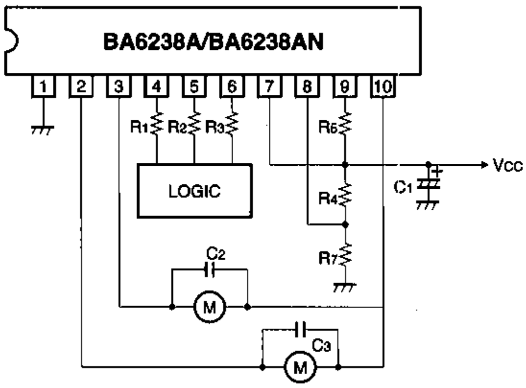


Fig.3 BA6238A / BA6238AN

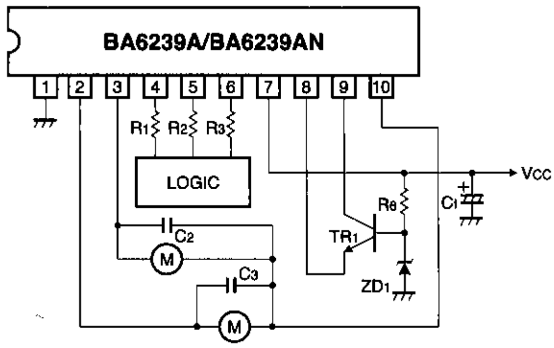


Fig.4 BA6239A / BA6239AN

●Input/output truth table

Input			Output			Function
4pin	5pin	6pin	10pin	2pin	3pin	
L	L	X	L	L	L	Brake
H	L	L	H	L	OPEN	Current flow from pin 10 to pin 2
H	L	H	L	H	OPEN	Current flow from pin 2 to pin 10
L	H	L	H	OPEN	L	Current flow from pin 10 to pin 3
L	H	H	L	OPEN	H	Current flow from pin 3 to pin 10
H	H	X	L	L	L	Brake

X : Don't care

●Circuit operation

(1) Input (pins 4, 5, and 6)

These pins receive control logic signals. The relevant circuits are designed to have hysteresis and antinoise characteristics. The input circuit can control the logic by input currents of a few microamperes or more. The motor connected between pins 10 and 2 is selected when pin 4 is HIGH and pin 5 is LOW, while the motor connected between pins 10 and 3 is selected when pin 5 is HIGH and pin 4 is LOW. Pin 6 is the forward / reverse control input pin.

(2) Output (pins 2, 3, and 10)

Pin 10 is the common pin. Either pin 2 or 3 is left OPEN during motor driving. The waveform monitored on the OPEN pin will be the same as that on pin 10.

1) BA6238A/BA6238AN

The output stage configuration of the BA6238A/BA6238AN is shown in Fig. 5. The output stage contains NPN transistors in a Darlington configuration, which means the saturation voltage between V_{CC1} and the output pin is rather high but the output voltage can be easily set by using a zener diode or a resistor voltage divider. The voltage on the V_R pin can be varied from 0V to V_{CC1}. The output voltage is at the maximum when pin 8 is OPEN.

$V_{OH}=V_{CC1}-V_{sat}$ (PNP) $-2\times V_{BE}$ (NPN Darlington)

$V_{OL}=V_{sat}$ (NPN Darlington)

V_{sat} and V_{BE} are functions of the output current (see Fig. 17).

2) BA6239A/BA6239AN

The output configuration of the BA6239A/BA6239AN is shown in Fig. 6. Because the output stage contains only one NPN transistor, the saturation voltage between pin 8 and the output pin is about 0.7V less than that in the BA6238A. The output voltage is controlled by the pin-8 voltage. The voltage on the V_R pin can be varied from 8V to V_{CC1}. The output voltage is at the maximum when pin 8 is V_{CC1}.

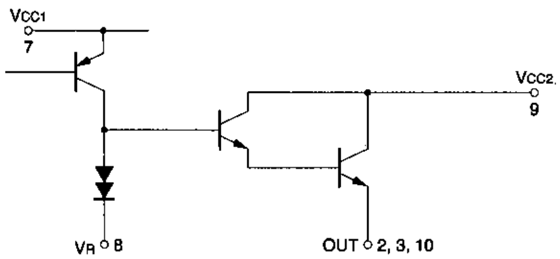


Fig.5

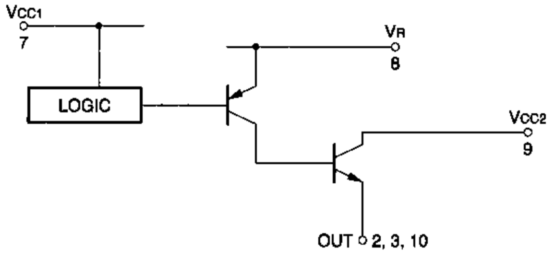


Fig.6

$V_{OH}=V_R-V_{sat}$ (PNP) $-V_{BE}$ (NPN)

$V_{OL}=V_{sat}$ (NPN Darlington)

V_{sat} and V_{BE} are functions of the output current (see Fig. 18).

(3) Output control (pin 8)

Output voltage can be varied by controlling the pin-8 voltage.

1) BA6238A/BA6238AN

The pin-8 voltage can vary from 0V to V_{CC}. Because a constant current (0.6mA typically) flows out from pin 8, the output voltage can be controlled by using a zener diode or a resistor voltage divider.

2) BA6239A/BA6239AN

In addition to controlling the output voltage, pin 8 supplies base current to the high-side output transistor (NPN).

(4) Power supply (pins 7 and 9)

Pin 7 supplies power to the input, logic, and thermal shutdown circuits. Pin 9 supplies power to the output transistors.

(5) Thermal shutdown circuit

Regardless of the input mode, the thermal shutdown circuit puts the outputs to LOW level when the chip temperature rises due to such an event as motor locking. When the thermal shutdown circuit is deactivated, the outputs revert to the status determined by input mode.

The thermal shutdown circuit is activated when the chip temperature exceeds 150℃ (125℃ minimally), and deactivated when the chip temperature drops to 100℃ (125℃ maximally). The minimum temperature difference between the activation and deactivation settings is 10℃.

(6) Ground pin and fins

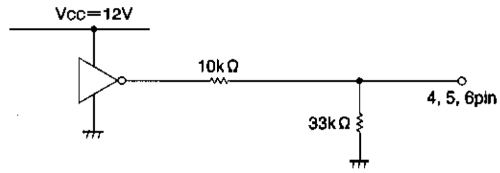
Pin 1 and the fins have the minimum potential within the IC. The PCB design should ensure that the common impedance is kept as low as possible when a large current flows.

●Operation notes

(1) Though the IC input pins can be directly connected with MOS output pins, it is recommendable to connect resistors of about 3 ~ 30kΩ between the pins for the sake of pin protection (see Fig. 7).

(2) When reversing the rotational direction of a motor, make sure to go through the brake mode in-between the opposite directions. It is recommendable to keep the brake mode for at least 10 μs.

(3) Powering procedures should be designed so that V_{CC1} (pin 7) always rises first and falls last.



Vcc =CMOS output with Vcc = 12 V

Fig.7

●Electrical characteristic curves

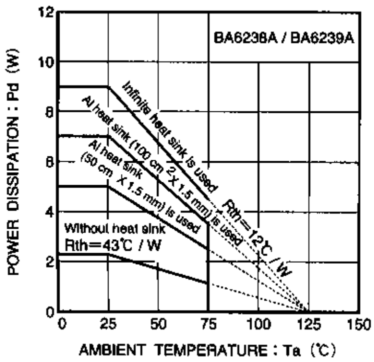


Fig.8 Power dissipation curves (BA6238A/BA6239A)

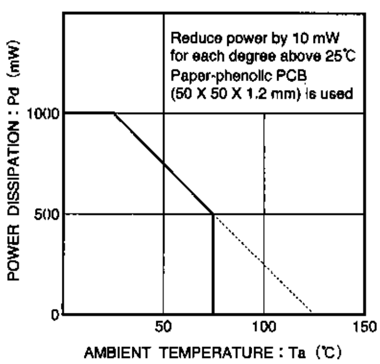


Fig.9 Power dissipation curve (BA6238AN/BA6239AN)

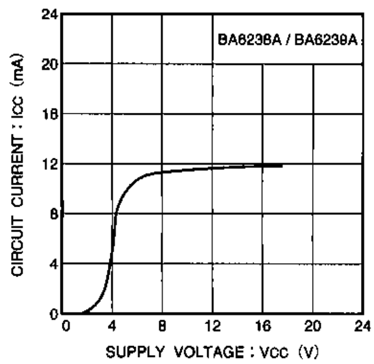


Fig.10 Circuit current vs. supply voltage

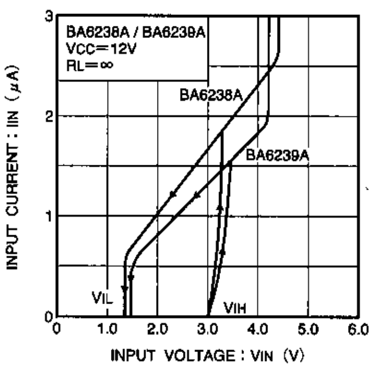


Fig.11 Input current vs. input voltage

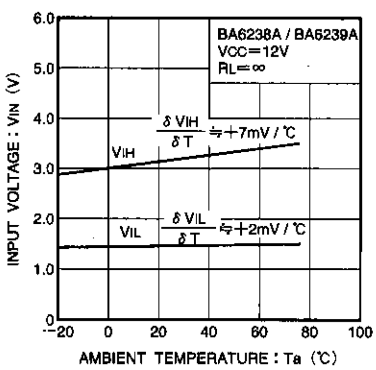


Fig.12 Input voltage vs. ambient temperature

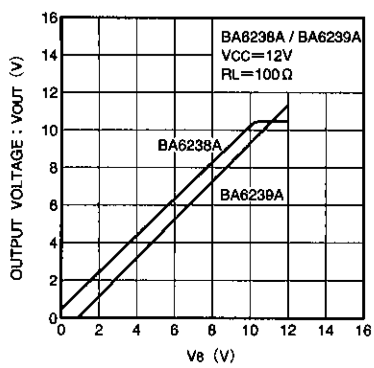


Fig.13 Output voltage vs. pin-8 voltage

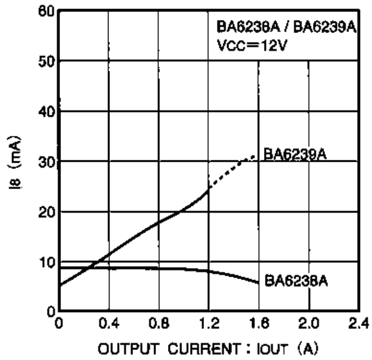


Fig.14 Pin-8 current vs. output current

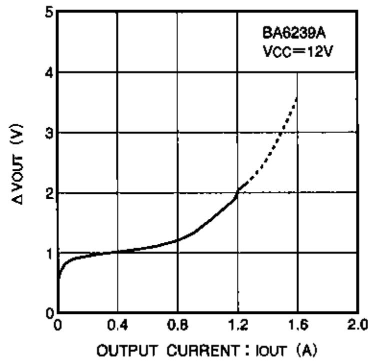


Fig.15 Output voltage variation vs. output current

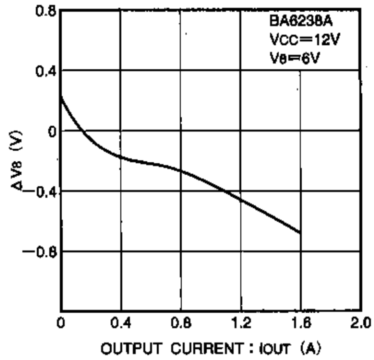


Fig.16 Pin-8 voltage variation vs. output current

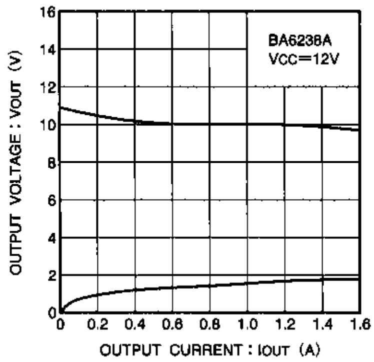


Fig.17 Output voltage vs. output current (BA6238A)

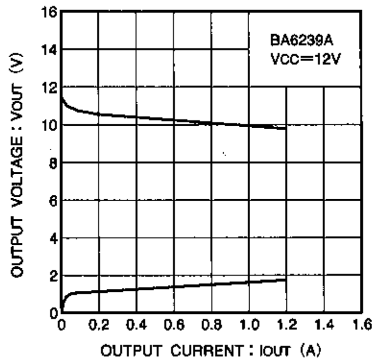
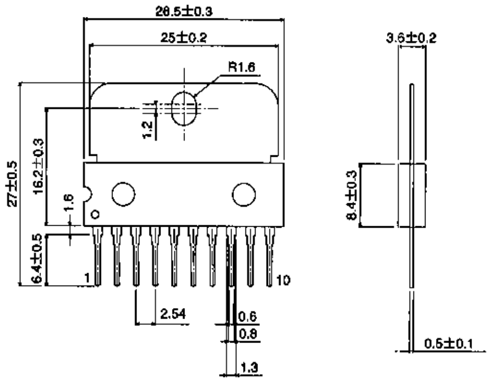


Fig.18 Output voltage vs. output current (BA6239A)

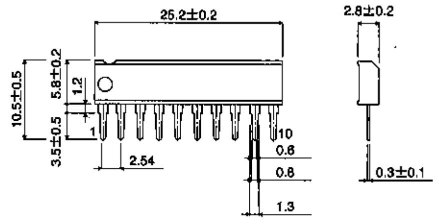
●External dimensions (Units: mm)

BA6238A/BA6239A



HSIP10

BA6238AN/BA6239AN



SIP10